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# 5-Axis Machining Center for Small Components

NCDMM Project No. 06-0104-07



## PROBLEM / OBJECTIVE

Letterkenny Army Depot (LEAD), Chambersburg, PA is currently manufacturing a variety of small components using a large 5-axis computer numerical control (CNC) machining center. When these small components are produced, roughly five percent of the machining table is used.

LEAD also produces various sized threaded holes in armor plate material. Due to the properties of armor plate material, producing the smaller size threaded holes (#10-32) has become a major challenge. This results in additional production time as compared to producing larger threaded holes. Due to the increased demand for the manufacturing of small components and threading small holes in armor plate, LEAD called upon the National Center for Defense Manufacturing and Machining (NCDMM) to research and provide a more efficient solution to their 5-axis machining along with a manufacturing process to produce #10-32 threaded holes in armor plate to specifications required by LEAD.

## ACCOMPLISHMENTS / PAYOFF



Threaded #10-32 Holes  
in Armor Plate



Drill and #10-32 Threadmill

### Process Improvement

The NCDMM initiated the solution development for eliminating the need for LEAD to manufacture small components with the use of the large 5-axis CNC machining center by researching different Haas trunnion models that would fit one of LEAD's current 3-axis Haas CNC machining centers. This solution optimizes the use of the smaller CNC machining center and in turn makes the larger 5-axis CNC machining center available for larger work pieces more suitable for its capabilities. Once the research was completed, an appropriate Haas trunnion was selected and delivered to LEAD.

The development of a solution for threading #10-32 holes in the armor plate was initiated by having armor

plate material, supplied by LEAD, sent to the NCDMM facility for testing. The first phase began by researching various threadmill companies to supply tools for this task. Once the cutting tools were selected, they were tested and evaluated at different cutting speeds and feeds using a Design of Experiment (DOE). Photos of the cutting tools were taken, tool wear was measured, and all the data was recorded.

The test results identified the optimal cutting speeds and feeds for threadmilling #10-32 holes in armor plate material along with a decision on which cutting tool would merit additional testing to determine cutter life.

Follow-up life test results showed an average of 101 #10-32 threaded holes could be achieved with a single cutting tool before any significant tool wear appeared. The NCDMM, with the assistance from its Alliance Partners, was able to combine key technologies that efficiently produce these components to specifications required by LEAD.

### Implementation and Technology Transfer

The following process and tool recommendations were made to LEAD:

- Addition of a Haas trunnion on LEAD's current 3-axis Haas machining center
- Verification of the threadmilling process to be implemented at LEAD
- Programming techniques to threadmill armor plate material

### Expected Benefits

- Increased productivity resulting in better utilization of the larger 5-axis CNC machining center
- Ability to produce #10-32 threaded holes in armor plate

## TIME LINE / MILESTONE

Start Date.....July 06  
Recommendations Made.....Feb 07

## PROJECT FUNDING

NCDMM Effort.....\$85K

## PARTICIPANTS

Emuge  
Haas Automation, Inc.  
Kennametal Inc.

Kurt Manufacturing  
Letterkenny Army Depot (LEAD)  
NCDMM

For additional information concerning this project,  
contact the NCDMM at [www.ncdmm.org](http://www.ncdmm.org)